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ORIGINAL CONTRIBUTION

Subsequent Criminal Activity Among Violent Misdemeanants Who Seek to Purchase Handguns

Risk Factors and Effectiveness of Denying Handgun Purchase

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Context Some states prohibit the purchase of handguns by persons convicted of selected misdemeanor crimes, but most do not. California has denied handgun purchases by violent misdemeanants since 1991; the effectiveness of these policies is unknown.

Objective To determine the risk factors for new criminal activity among violent misdemeanants who seek to purchase handguns and whether denial of handgun purchase by violent misdemeanants affects their risk of arrest for new crimes, particularly gun and/or violent crimes.

Design Retrospective, population-based cohort study.

Setting and Subjects Persons aged 21 to 34 years who sought to purchase a handgun through a licensed dealer in California during 1989-1991 and who had at least 1 violent misdemeanor conviction in the preceding 10 years. The study cohorts consisted of 986 persons whose purchase applications were made in 1991 and were denied (denied persons) and 787 persons whose purchase applications were made in 1989-1990 and were approved (purchasers).

Main Outcome Measures Incidence and relative risk of first arrest in California for new gun and/or violent crimes and for nongun, nonviolent crimes during a 3-year follow-up after actual or attempted handgun purchase.

Results During the 3-year follow-up, 546 (33.0%) of 1654 subjects with follow-up information were arrested for a new crime, including 296 (31.9%) of 927 denied persons and 250 (34.4%) of 727 purchasers. After adjusting for differences in age, sex, and prior criminal history, purchasers were more likely than denied persons to be arrested for new gun and/or violent crimes (relative hazard [RH], 1.29; 95% confidence interval [CI], 1.04-1.60), but not for nongun, nonviolent crimes (RH, 0.96; 95% CI, 0.78-1.19). In both groups, risk of arrest was strongly related to age and number of convictions accrued prior to actual or attempted handgun purchase.

Conclusion Our results indicate that denial of handgun purchase to violent misdemeanants is associated with a specific decrease in risk of arrest for new gun and/or violent crimes.

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RATES OF GUN VIOLENCE remain above those of the early 1960s, when the modern epidemic of gun violence began.[1] In 1999, more than 560 000 violent crimes, including approximately 10 000 homicides, were committed with guns in this country.[2,3] Preliminary data for 2000 suggest that the decline in gun violence may itself be ending.[4] The nationwide aggregate cost of gun violence has been estimated at $100 billion per year.[5]

Prohibiting the purchase of guns by persons believed to be at high risk for future criminal activity has become a widely accepted violence prevention policy. Some 327 000 persons, 2.6% of those who applied, were denied the purchase of a handgun, rifle, or shotgun in 1999.[6] Denial of handgun purchases by felons has been associated with a reduction in their risk of committing new gun and/or violent crimes of approximately 20% to 25%.[7]

The Gun Control Act of 1968 prohibits the purchase of guns by felons, fugitives, narcotics addicts, persons who have been adjudicated mentally ill, illegal aliens, and certain others; persons younger than 21 years are prohibited from purchasing handguns.[8] Recent amendments have extended the federal prohibition to include persons convicted of misdemeanor domestic violence crimes or subject to domestic violence restraining orders.

These prohibitions notwithstanding, it remains the case that "a considerable fraction of people who commit violent crimes are legally entitled to own guns."[9] In particular, persons convicted of misdemeanor crimes who legally purchase handguns are at high risk

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for committing new gun and/or violent crimes. Male handgun purchasers with 1 prior conviction for a violent misdemeanor, compared with those with no prior criminal history, are more than 8 times as likely to be charged later with gun and/or violent crimes; among those with multiple such convictions, risk is increased more than 10-fold.[10]

By 1999, 17 states and the District of Columbia prohibited handgun purchases by persons convicted of selected misdemeanor crimes.[11] Since 1991, California has prohibited the purchase or possession of handguns by persons convicted of common violent misdemeanors, such as assault and battery, resisting arrest, and brandishing a firearm, for 10 years following the conviction. Such a history is now the most common reason for denial of handgun purchase in the state (unpublished data, California Department of Justice, 1999).

To our knowledge, the effectiveness of prohibiting handgun purchases by violent misdemeanants has not previously been assessed. We undertook a population-based retrospective cohort study of this question. Our primary study cohort consisted of all persons younger than 35 years who sought to purchase a handgun in California in 1991 and whose handgun purchases were denied as a result of a prior violent misdemeanor conviction. Our comparison cohort was made up of all persons younger than 35 years who legally purchased handguns in California in 1990 or 1989, just before the new law went into effect, and who in the 10 years prior to their handgun purchase had a violent misdemeanor conviction that became grounds for denial in 1991. Our primary hypothesis was that denial of handgun purchase would be associated with a decrease in risk of first arrest for new gun and/or violent crimes, but not for nongun, nonviolent crimes.

METHODS

The California Department of Justice supplied records for all denials of handgun purchase in 1991 and all reported handgun purchases made in 1989 or 1990. Denial records included the specific crime or other reason for which the denial was made.

The California Department of Justice also performed a computer-based review of its Automated Criminal History System (ACHS) to identify persons who, in 1990 or previously, had been convicted of violent misdemeanors that became grounds for denial of handgun purchase in 1991. The ACHS was implemented in the early 1970s and contained the complete contents of all criminal records of persons who were younger than 35 years in 1990. Pre-existing manual records for older persons were not always automated for inclusion in ACHS, and automated and nonautomated records differed in the number of arrests and convictions they contained. To avoid selection bias, we therefore restricted our study to persons younger than 35 years at the time of actual or attempted handgun purchase.

Last name and date of birth were used to identify tentative matches between persons listed in the 1989-1990 handgun purchaser data and persons recorded in ACHS as having violent misdemeanor convictions by 1990. All tentative matches were confirmed by manual records review. Criminal records for all subjects in both cohorts were reviewed to verify that each had a violent misdemeanor conviction within 10 years of actual or attempted handgun purchase. We used double data entry procedures for all study data sets, with computerized and manual comparisons.

We identified 1099 persons younger than 35 years whose handgun purchases had been denied for a prior violent misdemeanor conviction in 1991, and 877 persons younger than 35 years who had purchased handguns in 1989 or 1990 and within the preceding 10 years had been convicted of a violent misdemeanor that became grounds for denial in 1991. We excluded 23 persons from the denied cohort who appeared to have been denied in error: 22 whose convictions were more than 10 years prior to the date of their handgun purchase applications and 1 whose conviction was for a crime that did not constitute grounds for denial. Another 90 persons purchased handguns in 1989 or 1990 and then were denied when they attempted to purchase handguns in 1991. Preliminary analyses performed with these persons included and excluded yielded nearly identical results. Retaining these persons as members of both cohorts would have complicated the interpretation of the results of the study, and they were therefore excluded.

Crimes were grouped into the following discrete classes: nongun, nonviolent crimes (eg, petty theft, driving under the influence of alcohol); nonviolent gun crimes (eg, carrying a concealed firearm in a public place); and violent crimes (eg, simple and aggravated assault, robbery, murder). Unfortunately, California's criminal records did not reliably distinguish between violent crimes that involved guns and those that did not. Our records review established that in the period prior to actual or attempted handgun purchase, convictions for nonviolent gun crimes made up only 4.4% of convictions for all crimes involving guns, violence, or both guns and violence. We therefore defined the main outcome event for the study as the first arrest for a new gun and/or violent crime. Additional analyses provided separate results for nongun, nonviolent crimes; nonviolent gun crimes; violent crimes; and all crimes combined.

The follow-up period began 15 days following application for handgun purchase—the first day on which legal acquisition of the handgun could have occurred, if permitted—and ended 3 years later. Only arrests occurring in California were eligible for consideration as outcome events, as reliable data were not available for arrests occurring elsewhere. Subjects were considered to be at risk for those events for only as long as their continued residence in California could be verified independently. This was done by linkage to the state's driver's license records, credit agency data, computerized telephone directories, and state and national mortality files. Subjects without such in-

dependent follow-up were excluded from outcome analyses. However, to allow for an estimate of the possible bias introduced by lack of follow-up, data on new arrests were also collected for subjects for whom follow-up was not available.

The probability of experiencing a first new arrest was estimated by the Kaplan-Meier method.[12] The significance of differences in probabilities was assessed by the log-rank statistic. Crude incidence rates of first arrest were calculated as the number of persons experiencing a first arrest divided by the person-time under observation.

Cox proportional hazards regression was used to calculate univariate and adjusted relative hazards (RHs) and 95% confidence intervals (CIs).[13] A model including age, sex, race, and number of prior criminal convictions was used to estimate adjusted RHs. Time since actual or attempted handgun purchase was measured in days. Other continuous variables were stratified: age (21-24, 25-29, and 30-34 years); prior convictions for any crime (1, 2, 3, and ≥4); prior convictions for gun and/or violent crimes (1, 2, and ≥3). Subjects for whom the number of prior convictions could not be determined (12 persons in the case of prior convictions for any crime, 21 persons for prior gun and/or violent crime convictions) were excluded from multivariate analyses; all were denied persons.

The addition of terms for interactions between study cohort and age, study cohort and number of prior convictions, and age and number of prior convictions did not improve the fit of the model; none were included in the final model. Similarly, inclusion of measures of the elapsed time between the most recent prior conviction for any crime and for any gun and/or violent crime did not improve the fit of the model, and these were not retained. Reliance on the proportional hazards assumption was validated by plotting Schoenberg residuals for individual covariates against time.[14]

The primary regression analysis examined risk for experiencing a first arrest. A conditional, total time recurrent-events model was developed to study effects as additional arrests occurred and as time since actual or attempted purchase increased. In the recurrent events analysis, an overall effect estimate was generated for each covariate.[14-16]

The significance of differences between subjects with and without independent follow-up was estimated using the χ^2 statistic.

All tests of significance were 2-sided, with a P value of $<.05$ considered to indicate statistical significance. SAS software was used for all analyses (PC-SAS, Version 8, SAS Institute, Cary, NC).

Table 1. Demographic and Prior Criminal History Characteristics of Violent Misdemeanants Who Applied to Purchase Handguns in California*

Characteristic	Purchase Denied, 1991 (n = 986)	Purchase Approved, 1989-1990 (n = 787)
Sex		
Male	945 (95.8)	757 (96.2)
Female	41 (4.2)	30 (3.8)
Age, y		
21-24	234 (23.7)	172 (21.9)
25-29	411 (41.7)	360 (45.7)
30-34	341 (34.6)	255 (32.4)
Race/ethnicity		
White	455 (46.1)	370 (47.0)
Black	157 (15.9)	99 (12.6)
Hispanic	296 (30.0)	228 (29.0)
Asian/other	48 (4.9)	35 (4.4)
Missing/unknown	30 (3.0)	55 (7.0)
No. of prior convictions†		
Any crime		
1	504 (51.7)	382 (48.5)
2	253 (26.0)	196 (24.9)
3	102 (10.5)	111 (14.1)
≥4	115 (11.8)	98 (12.5)
Gun and/or violent crime		
1	737 (76.4)	573 (72.8)
2	163 (16.9)	161 (20.5)
≥3	65 (6.7)	53 (6.7)

*Data are expressed as number and percentage. Percentages may not add to 100% due to rounding.
†Because records were incomplete, the number of convictions for any crime was unknown for 12 denied persons, and the number of convictions for gun and/or violent crimes was unknown for 21 denied persons. Percentages are of subjects for whom the number of convictions was known.

RESULTS

After exclusions, the study cohorts were made up of 986 persons who were denied the purchase of a handgun in 1991 (denied persons) and 787 persons who purchased a handgun in 1989 or 1990 (purchasers). The demographic and prior criminal history characteristics of the 2 cohorts were very similar; 23.1% of denied persons and 27.2% of purchasers had been convicted of more than 1 violent misdemeanor that had become grounds for denial of handgun purchase in 1991 (TABLE 1).

Independent evidence of subjects' continued residence in California for the entire 3-year follow-up period was available for 83.9% of denied persons and 84.6% of purchasers. Another 10.1% of denied persons and 7.8% of purchasers were confirmed as alive and in the state for part of the follow-up period (median, 1.7 years for both groups). No follow-up information was available for 119 subjects. Absence of follow-up was not related to subjects' study cohort (7.6% [n=60] for purchasers and 6.0% [n=59] for denied persons, $P=.17$), sex ($P=.56$), age group ($P=.89$), number of prior convictions for any crime ($P=.08$), or gun and/or violent crimes ($P=.30$).

Over 3 years following their actual or attempted handgun purchases, 546 (33.0%) of 1654 subjects with follow-up were arrested for a new crime, including 296 (31.9%) of 927 denied

persons and 250 (34.4%) of 727 purchasers (TABLE 2). Purchasers were more likely than denied persons to be arrested for a new gun and/or violent crime (23.9% and 20.1%, respectively, log-rank $P=.048$) (FIGURE 1A), but not for a new nongun, nonviolent crime (21.3% and 22.8%, respectively, log-rank $P=.46$) (Figure 1B). Among the 119 subjects with no follow-up, purchasers were more likely than denied persons to experience a new arrest for any crime (46.7% and 28.8%, respectively, $P=.04$), a nongun, nonviolent crime (33.3% and 23.7%, respectively, $P=.25$), and a gun and/or violent crime (31.7% and 22.0%, respectively, $P=.24$).

The results of univariate analysis are presented in Table 2. Crude first-arrest rates for new gun and/or violent crimes were 9.9 per 100 person-years for purchasers and 8.0 per 100 person-years for denied persons (RH, 1.23; 95% CI, 1.00-1.52). There was no significant difference between the 2 groups in risk of arrest for nongun, nonviolent crimes. Among purchasers, the arrest rate for gun and/or violent crimes exceeded that for nongun, nonviolent crimes; among denied persons, the opposite was true. When both denied persons and purchasers were considered together, males were at increased risk of arrest for gun and/or violent crimes; risk of arrest for all crime categories was strongly related to age (Table 2, FIGURE 2) and number of prior criminal convictions (Table 2, FIGURE 3).

These results were generally confirmed in multivariate analysis (TABLE 3). Purchasers remained more likely than denied persons to be arrested for new gun and/or violent crimes (RH, 1.29; 95% CI, 1.04-1.60) but not for nongun, nonviolent crimes (RH, 0.96; 95% CI, 0.78-1.19). Adjusted risk of first arrest for all crime types decreased by more than 50% as age increased. Risk of arrest increased for all crime types with the number of prior convictions for any crime, but an increasing number of prior convictions for gun and/or violent crimes was associated only with an increased risk of arrest for new crimes of that type.

When nonviolent gun crimes and violent crimes were considered separately, results were similar to those for all gun and/or violent crimes considered together. After adjustment, purchasers were more likely than denied persons to be arrested for both violent crimes (RH, 1.24; 95% CI, 0.98-1.58) and nonviolent gun crimes (RH, 1.46; 95% CI, 0.98-2.17). For both study cohorts combined, subjects aged 30 to 34 years were substantially less likely than those aged 21 to 24 years to be arrested for either violent crimes (RH, 0.49; 95% CI, 0.36-0.67) or nonviolent gun crimes (RH, 0.36, 95% CI, 0.21-0.62). Subjects with 3 or more prior convictions for a gun and/or violent crime were more likely than were

Table 2. Incidence and Crude Relative Hazard (RH) of First Arrest for New Crimes Among Violent Misdemeanants Who Applied to Purchase Handguns*

		Any Crime			Gun and/or Violent Crime			Nongun, Nonviolent Crime		
Characteristic	No. of Subjects	No. (%) Arrested	No. of Events per 100 Person-Years	Crude RH (95% CI)	No. (%) Arrested	No. of Events per 100 Person-Years	Crude RH (95% CI)	No. (%) Arrested	No. of Events per 100 Person-Years	Crude RH (95% CI)
All subjects	1654	546 (33.0)	14.7		360 (21.8)	8.8		366 (22.1)	9.0	
Purchase status										
Denied	927	296 (31.9)	14.1	1.00 (Referent)	186 (20.1)	8.0	1.00 (Referent)	211 (22.8)	9.3	1.00 (Referent)
Approved	727	250 (34.4)	15.5	1.10 (0.93-1.30)	174 (23.9)	9.9	1.23 (1.00-1.52)	155 (21.3)	8.6	0.93 (0.75-1.14)
Sex										
Female	65	21 (32.3)	14.3	1.00 (Referent)	11 (16.9)	6.6	1.00 (Referent)	15 (23.1)	9.5	1.00 (Referent)
Male	1589	525 (33.0)	14.7	1.02 (0.66-1.58)	349 (22.0)	8.9	1.34 (0.74-2.45)	351 (22.1)	9.0	0.94 (0.56-1.58)
Age, y										
21-24	377	163 (43.2)	21.0	1.00 (Referent)	108 (28.6)	12.3	1.00 (Referent)	117 (31.0)	13.3	1.00 (Referent)
25-29	719	234 (32.5)	14.4	0.70 (0.57-0.85)	152 (21.1)	8.5	0.70 (0.55-0.89)	152 (21.1)	8.6	0.65 (0.51-0.83)
30-34	558	149 (26.7)	11.3	0.55 (0.44-0.69)	100 (17.9)	7.1	0.58 (0.44-0.76)	97 (17.4)	6.8	0.52 (0.40-0.68)
Prior convictions										
Any crime										
1	815	209 (25.6)	10.8	1.00 (Referent)	144 (17.7)	7.0	1.00 (Referent)	126 (15.5)	6.0	1.00 (Referent)
2	429	147 (34.3)	15.2	1.40 (1.14-1.73)	90 (21.0)	8.4	1.19 (0.92-1.55)	104 (24.2)	9.9	1.65 (1.27-2.14)
3	200	87 (43.5)	21.0	1.90 (1.48-2.44)	57 (28.5)	12.1	1.70 (1.25-2.31)	58 (29.0)	12.2	2.01 (1.47-2.75)
≥4	198	95 (48.0)	25.4	2.26 (1.77-2.88)	63 (31.8)	14.1	1.97 (1.47-2.65)	73 (36.9)	17.2	2.79 (2.09-3.73)
Gun and/or violent crime										
1	1217	359 (29.5)	12.7	1.00 (Referent)	230 (18.9)	7.5	1.00 (Referent)	241 (19.8)	7.9	1.00 (Referent)
2	302	123 (40.7)	19.6	1.50 (1.23-1.85)	86 (28.5)	12.3	1.60 (1.25-2.05)	81 (26.8)	11.4	1.43 (1.11-1.84)
≥3	115	53 (46.1)	23.9	1.81 (1.36-2.42)	37 (32.2)	14.1	1.84 (1.30-2.60)	36 (31.3)	14.0	1.74 (1.23-2.47)

*Limited to subjects for whom follow-up independent of new criminal activity was available. Subjects were excluded when the number of prior convictions was not precisely known (n = 12 for any convictions, n = 20 for gun and/or violent convictions). CI indicates confidence interval.

Figure 1. Kaplan-Meier Event Curves for New Arrests, by Whether a Handgun Purchase Was Approved or Denied

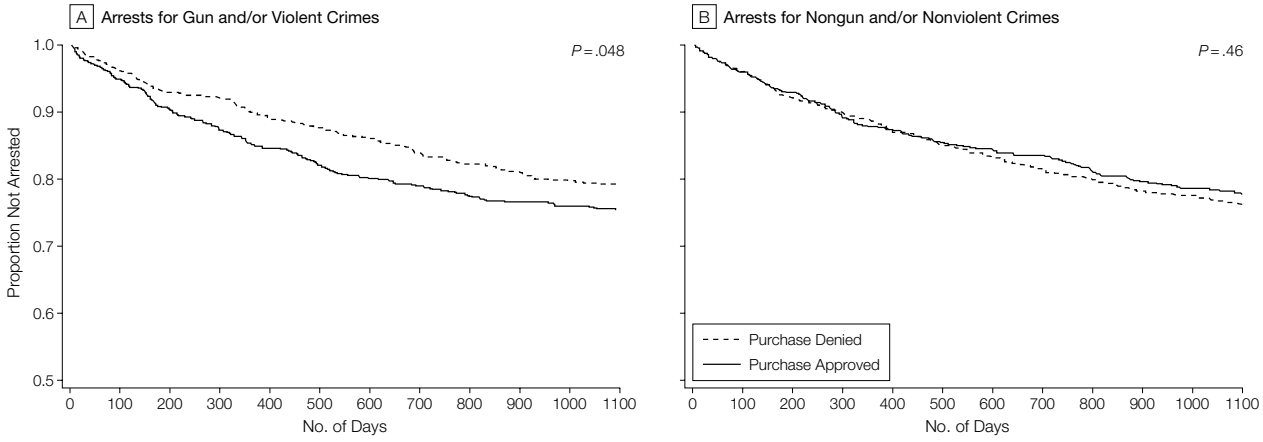


Figure 2. Kaplan-Meier Event Curves for New Arrests for Gun and/or Violent Crimes, by Age

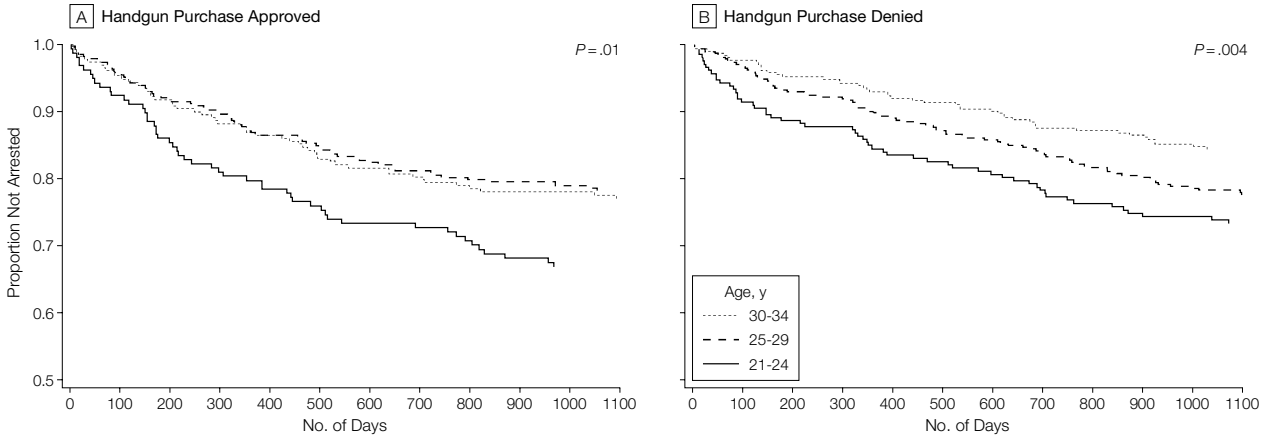
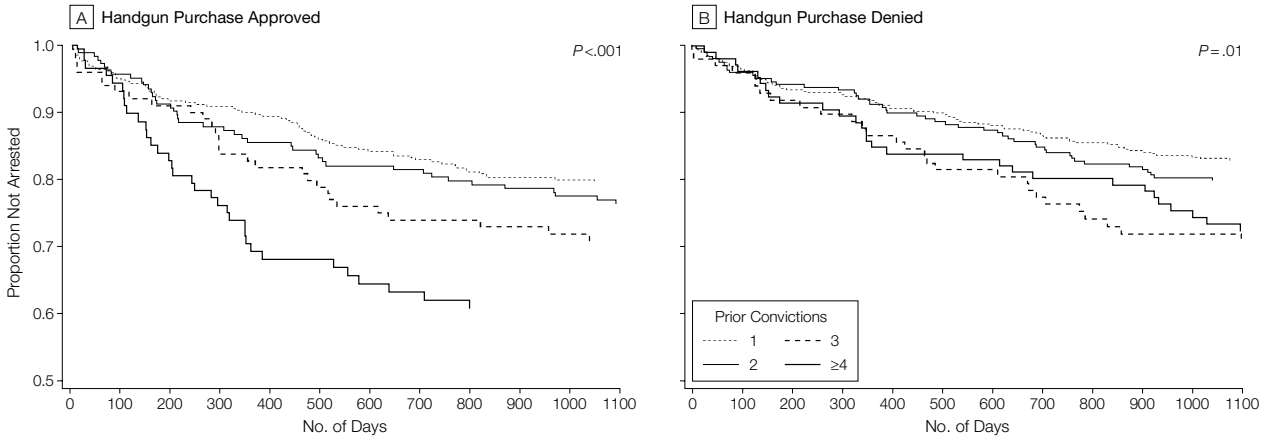


Figure 3. Kaplan-Meier Event Curves for New Arrests for Gun and/or Violent Crimes, by Number of Prior Convictions for Any Crime



subjects with 1 such conviction to be arrested for a violent crime (RH, 1.57; 95% CI, 0.97-2.54), but not a nonviolent gun crime (RH, 1.04; 95% CI, 0.38-2.83).

There was relatively little variation across age and prior criminal history strata in the increased risk of arrest for gun and/or violent crimes associated with handgun purchase (TABLE 4). In many instances, the increase in risk was modest and not statistically significant.

Over the entire period of follow-up, and including both first and subsequent arrests, the crude arrest rate for gun and/or violent crimes was 10.6 per 100 person-years for handgun purchasers and 9.5 per 100 person-years for denied persons; rates for nongun, nonviolent crimes were 11.8 per 100 person-years and 12.8 per 100 person-years, respectively. After adjustment, purchasers were at slightly greater risk of arrest for gun and/or violent crimes (RH, 1.12; 95% CI, 0.93-1.35) but not for nongun, nonviolent crimes (RH, 0.96; 95% CI, 0.81-1.14). Among subjects who were arrested for gun and/or violent crimes following actual or attempted handgun purchase, denied persons were slightly more likely than purchasers to be arrested more than once for such crimes (25.6% and 24.0%, respectively, $P = .12$).

Table 3. Adjusted Relative Hazard (RH) of First Arrest for New Crimes Among Violent Misdemeanants Who Applied to Purchase Handguns*

Characteristic	Any Crime, Adjusted RH (95% CI)	Gun and/or Violent Crime, Adjusted RH (95% CI)	Nongun, Nonviolent Crime, Adjusted RH (95% CI)
Purchase status			
Denied	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
Approved	1.15 (0.97-1.37)	1.29 (1.04-1.60)	0.96 (0.78-1.19)
Age, y			
21-24	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
25-29	0.70 (0.57-0.86)	0.70 (0.54-0.90)	0.64 (0.50-0.82)
30-34	0.46 (0.37-0.59)	0.48 (0.36-0.64)	0.44 (0.33-0.59)
Prior convictions			
Any crime			
1	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
2	1.36 (1.08-1.72)	1.01 (0.74-1.37)	1.71 (1.29-2.27)
3	1.99 (1.47-2.69)	1.52 (1.04-2.23)	2.47 (1.72-3.54)
≥4	2.40 (1.76-3.28)	1.77 (1.19-2.63)	3.47 (2.43-4.96)
Gun and/or violent crime			
1	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
2	1.06 (0.82-1.36)	1.39 (1.01-1.91)	0.85 (0.64-1.15)
≥3	1.04 (0.73-1.49)	1.28 (0.82-2.00)	0.84 (0.55-1.28)

*Limited to subjects for whom follow-up independent of new criminal activity was available. Subjects were excluded when the number of prior convictions was not precisely known (n = 12 for any convictions, n = 20 for gun and/or violent convictions). Relative hazards are adjusted for sex and all variables in the table. CI indicates confidence interval.

COMMENT

In this population of violent misdemeanants who sought to purchase handguns, risk for subsequent criminal activity was high. One person in 3 was arrested for a new crime at least once within 3 years of purchasing a handgun; more than 1 in 5 were arrested at least once for a new crime involving guns and/or violence. Risk of

Table 4. Adjusted Relative Hazard (RH) of Arrest for New Crimes for Handgun Purchasers Compared With Denied Persons Among Violent Misdemeanants Who Applied to Purchase Handguns*

	Any Crime			Gun and/or Violent Crime			Nongun, Nonviolent Crime		
	No. of Events per 100 Person-Years			No. of Events per 100 Person-Years			No. of Events per 100 Person-Years		
Characteristic	Purchase Approved	Purchase Denied	Adjusted RH (95% CI)	Purchase Approved	Purchase Denied	Adjusted RH (95% CI)	Purchase Approved	Purchase Denied	Adjusted RH (95% CI)
Age, y									
21-24	22.1	20.2	1.13 (0.82-1.56)	14.4	10.9	1.37 (0.92-2.03)	12.8	13.6	1.02 (0.69-1.50)
25-29	14.2	14.7	1.04 (0.80-1.36)	8.5	8.6	1.06 (0.76-1.48)	8.0	9.1	0.93 (0.67-1.29)
30-34	13.4	9.8	1.38 (0.98-1.94)	9.1	5.7	1.64 (1.07-2.51)	6.6	6.9	0.96 (0.63-1.46)
Prior convictions									
Any crime									
1	11.6	10.1	1.20 (0.91-1.60)	7.8	6.4	1.26 (0.89-1.78)	5.6	6.3	0.97 (0.67-1.39)
2	15.2	15.2	0.98 (0.70-1.37)	9.4	7.7	1.18 (0.77-1.83)	9.1	10.6	0.85 (0.57-1.28)
3	23.1	19.0	1.27 (0.82-1.96)	12.2	11.9	1.12 (0.65-1.93)	13.5	11.1	1.33 (0.79-2.25)
≥4	27.2	24.0	1.27 (0.83-1.96)	18.8	10.9	1.80 (1.05-3.09)	15.6	18.6	0.90 (0.55-1.47)
Gun and/or violent crime									
1	13.6	12.0	1.18 (0.95-1.47)	8.7	6.6	1.38 (1.05-1.81)	7.4	8.2	0.97 (0.74-1.26)
2	20.8	18.5	1.15 (0.80-1.65)	13.6	11.1	1.29 (0.84-2.00)	11.9	11.0	1.12 (0.72-1.75)
≥3	22.8	24.9	1.24 (0.70-2.21)	12.9	15.1	0.93 (0.47-1.84)	11.6	16.2	0.84 (0.42-1.68)

*Limited to subjects for whom follow-up independent of new criminal activity was available. Subjects were excluded when the number of prior convictions was not precisely known (n = 12 for any convictions, n = 20 for gun and/or violent convictions). Relative hazards are adjusted for sex and all variables in the table. CI indicates confidence interval.

arrest was directly related to the number of prior convictions subjects had acquired and inversely related to age, relationships that have been documented previously.[10,17-21]

Denial of handgun purchase was associated with a moderate decrease in risk of arrest for new gun and/or violent crimes, even when sex, age, and prior criminal history were taken into account. Several aspects of our findings suggest that this is a causal association. First, it is specific: denial of handgun purchase had no impact on risk for nongun, nonviolent crimes. Second, it is plausible: reduced access to guns in a high-risk population could be expected to reduce their risk of committing new gun and/or violent crimes, but not other crimes. Third, it is consistent: denial of handgun purchase was associated with a reduced risk for gun and/or violent crimes across the ranges of both age and severity of subjects' prior criminal activity. The magnitude of the effect, furthermore, is similar to that seen in an earlier study of the effectiveness of prohibiting handgun purchases by felons.[7]

Not surprisingly, the recurrent events analysis suggests that denial of handgun purchase has its greatest effect in reducing risk for a first arrest for a gun and/or violent crime. Its effectiveness would be expected to diminish as time since actual or attempted handgun purchase increased, and it would not be expected to have a substantial effect in preventing further new arrests for gun and/or violent crimes among persons who had already experienced 1 new arrest.

Our findings are subject to several limitations. The small size of the study population limited our statistical power to detect relative risks (RRs) that were below approximately 1.25, or higher for subgroup analyses. With RRs below 1.5, results should be interpreted with caution regardless of the size of the study population due to the potential impact of unmeasured factors.

We were unable to obtain independent follow-up for 6.7% of study subjects, but for several reasons do not believe this compromised our findings. The proportion of subjects without follow-up was not related to study cohort assignment (or any other hypothesized risk factor). Among these subjects, purchasers were more likely than denied persons to be arrested for new crimes—by much larger margins than those seen among subjects for whom follow-up was available. This suggests that excluding subjects without follow-up has caused us to underestimate the risk of arrest for new crimes associated with handgun purchase.

Our study involved a period of time when rates of violent crime were rising, and results may be different when rates are falling as they have been more recently. We note that this introduces a bias toward the null in our findings: if rising crime rates had an independent effect, they would most likely have increased the risk of new arrest among denied persons in our study, as their attempted purchases occurred 1 to 2 years after the members of our comparison cohort had purchased handguns.

Rising crime rates may account in part for the puzzling finding that the number of violent misdemeanants seeking to purchase handguns in 1991 was greater than that for 1989 and 1990 combined. Violent crime rates are closely linked to demand for handguns.[22] It is also possible that the upsurge in attempted purchases in 1991 represented a misinformed effort on the part of newly ineligible persons to purchase handguns before the new law was enforced; accelerated gun sales in anticipation of possible restrictions have been observed previously.[23]

Because the criminal records data were not sufficiently specific, we were unable to categorize crimes systematically as involving guns, violence, both, or neither. We were therefore unable to study the specific effect of California's denial policy on risk of arrest for violent gun crimes. It could be argued that the prevention of nonviolent gun crimes, particularly the illegal carrying of a concealed firearm in public, should not be an objective of policies that deny handgun purchases by persons believed to be at high risk of committing gun violence. We would disagree; illegal gun carrying is a necessary precursor to much violent gun crime, and controlled experiments have shown that law enforcement efforts to interdict illegal carrying have had substantial effects on the incidence of gun violence.[24,25]

Finally, this is a single state study, and no 2 states have adopted the same expanded denial criteria. New Jersey, for example, denies the purchase of a handgun to "any person who has been convicted of a crime."[11] Replications in several states would provide a more general estimate of the effectiveness of denial of handgun purchase.

Critics of programs to screen prospective purchasers of firearms and deny purchases by prohibited persons have suggested that they are unlikely to be effective, describing them in one case as a "sop to the widespread fear of crime."[26] They have argued that persons with criminal intent who are prevented from buying guns in the legal market will simply acquire them illegally. However, the formal, legal gun market is an important source of guns for purchasers with criminal intent. Among state prison inmates who were incarcerated for a crime involving a handgun, that handgun was as likely to have come from a gun store as from an obviously illegal supplier.[27] And aggressive law enforcement has begun to disrupt the operations of the illegal gun market.[22] Denial of legal access to handguns may have even greater impact now, as illegal access becomes more difficult, than during our study period.

We note that a recent evaluation of the impact of the Brady Handgun Violence Prevention Act, the federally mandated waiting period and background check for handgun purchases, did not detect an effect on criminal violence.[28] That evaluation measured changes in state-level homicide rates from 1994-1998. During those years, however, so few persons were denied the purchase of handguns that their expected 20% to 25% reduction in risk of committing gun and/or violent crimes[7] could not

have produced a measurable effect on homicide rates.[28,29]

The evidence presented here suggests that denying the purchase of handguns by violent misdemeanants is an effective means of preventing gun-related and violent crime in a high-risk population. However, there are substantial logistic considerations to be addressed before such a policy could be implemented nationwide. No federal registry of violent misdemeanants exists, and it may be difficult to compile one.[30,31] Such a registry would need to be updated on a continuing basis to prevent newly ineligible persons from purchasing handguns. Under the present National Instant Check System (NICS), more than 3353 prohibited persons, most of them felons, had inadvertently been permitted to purchase firearms by the end of 1999; their background checks had not been completed within the 72 hours allowed by NICS.[32] This risk could be minimized by reinstituting a waiting period to allow all background checks to be completed.

As Philip Cook and colleagues have noted, "an effective transfer-regulating scheme that prevents guns from going to dangerous people would be nearly as successful as a much more intrusive scheme targeted at current gun owners."[33] Prohibiting the purchase of handguns by persons convicted of violent misdemeanor crimes is supported by a substantial majority of gun owners—70% to 90%, depending on the specific crime—and by even larger majorities of the general public.[34]

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